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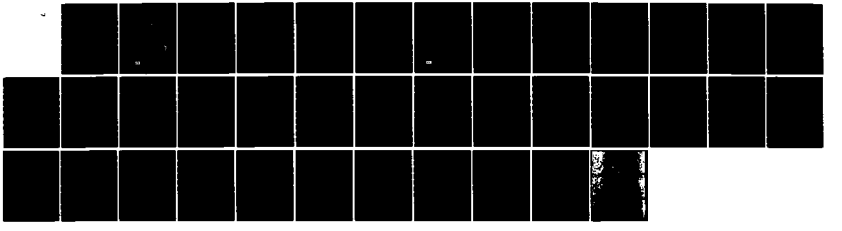

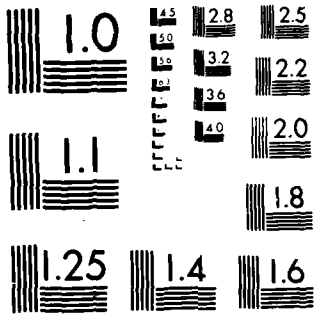

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A COST-BENEFIT ANALYSIS OF THE JOBS PROGRAM

Philip M. Lurie

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A COST-BENEFIT ANALYSIS OF THE JOBS PROGRAM

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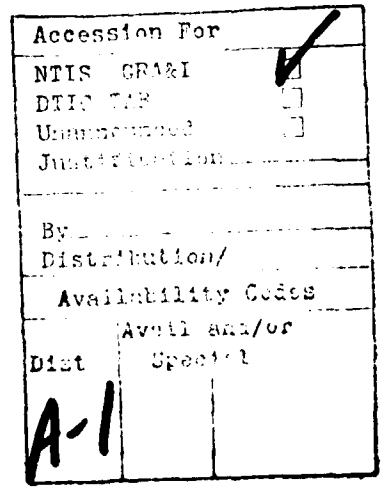
ABSTRACT

This study performs a cost-benefit analysis of the Job-Oriented Basic Skills (JOBS) remedial training program. The baseline case against which it is compared is the normal progression of "A"-school-qualified recruits into the fleet. Three measures of cost effectiveness are employed; in each case the two programs achieve similar results for a similar cost. It is recommended that the JOBS program be continued as a contingency in the event that certain ratings experience shortfalls of high-quality personnel in the future.



EXECUTIVE SUMMARY

The Job-Oriented Basic Skills (JOBS) program is an attempt to compensate for the skill deficiencies of lower-aptitude personnel through job-specific remedial training. It is seen as a possible way of filling technical positions in the fleet during times when "A"-school-qualified recruits are in short supply. The question we seek to answer in this paper is whether it is a cost-effective way of reducing these shortfalls.

The JOBS program is compared to the normal progression of "A"-school-qualified individuals into the fleet. Comparisons are made for four general areas of training (called strands): Propulsion Engineering (PE), Operations (OP), Administrative/Clerical (AC), and Electronics (EL). Our conclusions are summarized below:

- The JOBS program is slightly cost-effective (i.e., cheaper) in the OP, AC and EL strands.
- The JOBS program is only slightly more expensive than the regular "A" school program in the PE strand.
- Except for the OP strand, direct-track JOBS personnel (who attend JOBS school immediately after boot camp) are cheaper than delayed-track JOBS personnel (who spend 6-8 months in the fleet prior to JOBS school) when time in the fleet after "A" school graduation is taken into account.
- Except for the PE strand, delayed-track JOBS personnel are cheaper than direct-track JOBS personnel when time in the fleet and advancement patterns are taken into account.
- There is little difference in first-term survival among the direct and delayed-track JOBS groups and those who refuse JOBS training.

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INTRODUCTION

The Job-Oriented Basic Skills (JOBS) program was introduced in 1979 as an attempt to reduce shortfalls of qualified personnel in the fleet. Its aim is to reach individuals who would otherwise be assigned to the General Detail (GENDET) force, and to teach them the prerequisite skills and knowledge necessary to advance to the Navy's technical, i.e., Class "A", schools. If effective, the JOBS program would be of benefit to the Navy as it would increase the pool of talent available to fill technical positions.

Some indications of the effectiveness of the JOBS progr[illegible] are given in Baker and Hamovitch [1], who compare the progress of indi[illegible]uals in the program with that of "A"-school-qualified personnel. Th[illegible] data base consists of:

- 1,216 JOBS direct-track recruits who were to enter JOBS training immediately following recruit training,
- 1,802 JOBS delayed-track recruits who were to spend 6-8 months in the fleet as GENDETs before commencing JOBS training,
- 1,050 "A"-school-qualified recruits who entered "A" school immediately following recruit training,
- 276 "A"-school-qualified recruits who spent some time in the fleet as GENDETs before entering "A" school,
- 2,308 members of a fleet control group who were offered but refused JOBS training.

All of the "A"-school-qualified recruits attended "A" school at the same time as their JOBS-qualified counterparts. During the time period in question (JOBS and "A" school courses taking place from FY 1979 - FY 1981), JOBS training was available for four content strands. Each strand prepared the recruit for one of several "A" schools having common prerequisite skill and knowledge requirements. The four strands were Propulsion Engineering (PE), Operations (OP), Administrative/Clerical (AC), and Electronics (EL). Their lengths and "A" schools which they feed are shown in table 1.

Baker and Hamovitch showed that although JOBS graduates attrite from "A" school at a significantly higher rate (21 percent vs. 10 percent) than "A"-school-qualified recruits, their fleet discharge rate after graduation is less than half that of the "A" school group. This reduces the total loss rate differential between the two groups to only 3 percent. Thus it appears that the JOBS program has the potential for alleviating the Navy's technical manpower shortages. It remains to be

seen, however, whether the program is cost-effective. We will attempt to determine this in this paper.

TABLE 1

JOBS STRANDS AND "A" SCHOOLS INCLUDED

Strand	"A" Schools Included
PE (4 weeks)	Boiler Technician (BT) Engineman (EN) Machinist Mate (MM)
OP (4 weeks)	Operations Specialist (OS) Quartermaster (QM)
AC (5 weeks)	Aviation Storekeeper (AK) Personnelman (PN) Storekeeper (SK) Yeoman (YN)
EL (8 weeks)	Aviation Antisubmarine Warfare Technician (AX) Aviation Electronics Technician (AT) Aviation Fire Control Technician (AQ)

In order to determine whether the JOBS program is a cost-effective way of filling technical positions in the fleet, it must be compared with an alternative method. The most logical alternative is to access more "A"-school-qualified recruits into the Navy. This involves, of course, greater recruiting and advertising expenditures, but additional training expenses for JOBS courses are avoided. The JOBS recruits, on the other hand, are probably relatively inexpensive to recruit, but incur greater training costs. Thus, a cost-benefit analysis is required, which must take account of cost differences between the two programs, as well as differential attrition rates, to determine which program is the least expensive way of attaining the same objective.

In our analysis, we will consider three objectives. The first is to get the same number of recruits through "A" school, the second is to get the same amount of qualified (i.e., after "A" school graduation) fleet time, and the third is to get the same amount of qualified fleet time with the same advancement patterns. These are discussed in more detail later in this paper. The costs to be considered include recruiting, boot camp training, JOBS training, and "A" school training. These are discussed in the next section.

The data base we use for our analysis is an enhanced version of the one used by Baker and Hamovitch. At the time, and for the purposes of that study, the data base was as complete and up-to-date as possible. However, to satisfy the additional objectives of our study, we needed to supplement it. As an example, we needed to know exactly how long a person spent in JOBS and "A" school training in order to determine training costs. Therefore, records from the original data base were matched against Enlisted Master Records (FY 1978 - FY 1983) and Student Master Files (FY 1980 - FY 1981) to add the data needed. For instance, we were able to pick up 246 additional persons with complete JOBS information, and 619 persons (not necessarily exclusive of the 246 JOBS recruits) with complete "A" school information. In addition, each record in the file was updated until March, 1983, one year longer than the original file. This is a substantial enhancement of the original file since it is essential to follow a recruit's progress through JOBS training, "A" school, and the fleet to adequately determine the efficacy of the JOBS program.

CO ~ CONSIDERATIONS

This section summarizes the costs to be considered in our analysis. We also outline the assumptions and attrition results we use in comparing the JOBS program with the normal progression of "A"-school-qualified individuals into the fleet. The following cost elements are analyzed:

- Recruiting
- Boot Camp
- JOBS training
- "A" school training

Each of these elements is discussed below.

RECRUITING COSTS

Recruits who are "A"-school-qualified are generally in mental categories 1-3U, while those selected for the JOBS program are in categories 3L or 4. Almost all JOBS recruits are high school graduates; a smaller percentage of "A"-school-qualified recruits are high school graduates. Prior studies ([2] and [3]) suggest that recruiting costs depend strongly on an individual's educational level and mental group. This implies that recruiting costs for JOBS recruits and "A"-school-qualified personnel should differ significantly.

In analyzing the costs of JOBS, we make two contrasting assumptions about recruiting costs. On the one hand, we assume that the recruiting costs of the JOBS participants are minimal. This assumption is reasonable if one argues that recruiters and advertising are aimed primarily at high school graduates in the upper mental groups, but nevertheless attract additional high school graduates in the lower mental groups. In other words, even if the Navy decided not to take in any lower-mental-group people, the cost of those in the upper mental groups would be the same. This argument is based on the observation that the Navy has traditionally had problems attracting enough high school graduates in the upper mental groups but gets as many as it wants in the lower groups.

On the other hand, we assume that JOBS recruits cost the same as other high school graduates, so that recruiter and advertising costs should be allocated equally among all graduates, regardless of mental group. This assumption is harder to defend, but it should give an upper bound on the cost of recruiting a JOBS individual, and a lower bound on the cost of an "A"-school-qualified individual. In actuality, recruiting costs are likely to be somewhere in between the two extremes defined

by Assumptions 1 and 2. Thus, our assumptions cover the range of possible recruiting costs.

It should be noted that both Assumptions 1 and 2 consider non-high school graduates to be almost free to the Navy. Since this assumption is widely accepted, it will not be subjected to a sensitivity analysis.

Table 2 shows estimated Armed Forces Examining and Entrance Stations (AFEES) processing costs per accession (in FY 1982 dollars) for the years FY 1978 - FY 1981 based on a prior study by Clay-Mendez [4]. The processing costs differ from year to year because of varying accession to applicant ratios. Numbers of applicants and accessions to the Navy by educational level and mental group were provided to us by the Defense Manpower Data Center (DMDC).

TABLE 2

AFEES PROCESSING COSTS PER ACCESSION

	Year			
Accession type	1978	1979	1980	1981
HSDG, 1-3U	106	104	120	115
HSDG, 3L-5	124	111	123	141
NHSG, 1-3U	204	173	150	132
NHSG, 3L-5	404	385	349	462

Table 3 shows estimated marginal recruiting costs (recruiters and advertising) per accession to the Navy. The estimates were obtained from Clay-Mendez [3], who specifies recruiting costs in terms of numbers of high-school-diploma-graduate (HSDG) contracts. Since her results were based on FY 1979 data, we use the data supplied to us by DMDC on numbers of accessions in FY 1979 to determine the appropriate recruiting costs (in FY 1982 dollars).

TABLE 3

MARGINAL RECRUITING COSTS PER ACCESSION

Accession type	Marginal cost
HSDG, 1-3U	7,530
All HSDG	4,292

High school diploma graduates incur the recruiting costs shown in table 3 and the AFEES processing costs shown in table 2. Non-high school graduates (NHSG), on the other hand, incur only processing costs.

BOOT CAMP COSTS

Although all the JOBS and "A" school students in our sample have already completed boot camp, it is necessary to take account of boot camp attrition to determine replacement costs. For example, if the boot camp attrition rate was 20 percent and the Navy took 8 JOBS applicants at the end of boot camp, they would need to recruit and train 10 additional people to replace them. Thus both boot camp and recruiting costs must be adjusted upward. Estimates of boot camp attrition rates during FY 1979 by educational level, mental group, and age were obtained in [5]. We shall assume these rates apply during the time period in question.

For delayed-track JOBS and "A" school recruits, it is also necessary to take account of attrition in the fleet before commencing JOBS or "A" school training. The only problem is that many delayed-track JOBS recruits did not commence JOBS training during the time frame of the study. We do not want to consider later attrition of these recruits to have occurred before JOBS school attendance. To get around this problem, we computed the distribution of time to JOBS school attendance for those delayed-track personnel who had already attended JOBS school. The 95th percentile of this distribution is 68 weeks after completing boot camp. We therefore assume that any delayed-track recruit not having attended JOBS school within 68 weeks will never attend (with a 5 percent chance of our being in error). Similarly, any attrition before 68 weeks is assumed to be an attrition before JOBS training. Based on these assumptions, the attrition rate of delayed-track JOBS recruits is 9.5 percent.

To determine the pre-"A" school attrition rate of delayed-track "A" school personnel, we have to rely on historical data since every one of these individuals in our sample has attended "A" school. A GAO report [6], citing a 1979 Navy study using a time period of 65 weeks after boot camp (almost equal to the 68-week period we used for delayed-track JOBS recruits), gives the pre-"A" school attrition rate as 14 percent.

The cost of boot camp training was obtained in [7] as $2,642 in FY 1982 dollars. In order to determine how much the Navy needs to spend to get one person through boot camp and to subsequently attend JOBS or "A" school, we must adjust the above cost for the corresponding attrition rates. If we let S_1 denote the survival rate in boot camp and assume that dropouts leave at the midway point, and let S_2 denote the proportion of boot camp graduates that subsequently attend JOBS or "A" school (depending on the training sequence), then this adjustment becomes

$$\$2,642 \times [1 + 0.5 ((1/S_1) - 1)] / S_2 \quad (1)$$

$$= \$2,642 \times [(1+S_1)/(2S_1)] / S_2 \quad (2)$$

In equation (1), the first term in brackets, i.e., "1", denotes the boot camp training costs for those who completed, and the second term denotes the costs for those who dropped out. As noted before, the adjustment factor in equations (1) or (2) must also be used to adjust recruiting costs upward.

JOBS TRAINING COSTS

Costs of the JOBS program by strand for FY 1980 and FY 1981 were obtained from CNET. Table 4 shows the total costs, number of enrollees, and number of graduates by strand, location, and year.

TABLE 4

TOTAL JOBS COSTS

Course	No. of enrollees	No. of grads	Total cost
San Diego Operations FY 1980	155	143	158,134
San Diego Electronics FY 1980	37	31	62,546
San Diego Prop. Eng. FY 1980	226	216	327,914
San Diego Admin./Cler. FY 1980	149	140	228,865
San Diego Operations FY 1981	59	55	116,639
San Diego Electronics FY 1981	36	29	161,132
San Diego Prop. Eng. FY 1981	176	168	316,622
San Diego Admin./Cler. FY 1981	214	212	479,412
Memphis Electronics FY 1981	98	95	501,589
Great Lakes Prop. Eng. FY 1981	194	194	386,336
Meridian Admin./Cler. FY 1981	181	172	357,674

Four levels of accounting are used by CNET in preparing the JOBS cost data. These are:

- OH-1 (Overhead Level I). Includes the Commanding Officer and other organizational departments not directly involved in training, but who act as the support personnel for the entire training activity. Costs are prorated to the course level based on a percentage of course work units (man-months of training) to the total for the activity.
- OH-2 (Overhead Level II). The department levels of the training activity; includes the training department head

and staff. Costs (including labor, supplies, services, etc.) are prorated to the course level based on a percentage of course work units to the total for all the courses within the department.

- OH-3 (Overhead Level III). The division or third level of overhead. This level is provided to capture costs of instructors that teach in several courses of the division, clerical help providing services for several courses, and supplies or services that cannot be directly charged to a course. Costs are prorated to the course level based on a percentage of the course work units to the total for the courses in the division.

- Direct Level. Includes costs expended for materials, services, civilian and military labor, etc., that can be identified and charged to an individual course level.

To evaluate whether the JOBS program is a cost-effective way of filling rated positions, we need to determine the marginal cost of the program. We assume that the total cost of the program, as a function of man-months of training, is linear so that the cost to train a particular individual can be prorated on a daily basis. In this case, the marginal cost is just the average variable cost of the program. Thus, we need to sort out which costs are fixed and which are variable.

In a study of "A" school training costs (which have a similar accounting system), Warner et al. [8] found that OH-1 and OH-2 costs were fixed, i.e., they would be incurred even if the JOBS program did not exist. Cost elements which are included under these levels of overhead and which are considered fixed are:

1. Facility and host activity support, i.e., base operating costs allocated to each course on the basis of work units. These costs include utilities, water, use of vehicles, security, communications, maintenance, etc.

2. Automatic data processing support to CNET and subordinate facilities.

3. Other activity support that is not specifically defined.

4. Training equipment maintenance.

5. Naval Education Training Program Development Center (NETPDC) costs. NETPDC plans courses, develops exams, etc.

6. Functional Command, i.e., Naval Technical Training Command overhead costs allocated to courses by work units.

7. Equipment depreciation, which equals 10 percent of the purchase price (if over $1,000) of equipment on hand minus the scrap value.

8. Staff permanent change of station costs.

9. Staff family housing costs.

The following accounting cost elements (OH-3 and direct) are considered variable and are aggregated to determine the average variable cost of the JOBS program:

1. Overhead costs including instructor and support staff salaries.

2. Staff medical costs.

3. Student medical costs.

4. Student salaries.

5. Student travel costs.

Although student travel costs were supplied by CNET, we were unable to use them since they were allocated according to work units (this implies, for example, that someone in an 8-week course incurs twice the travel expense as someone in a 4-week course). This is probably sufficient for CNET's accounting purposes, but for our analysis we need travel costs on a non-prorated basis. We therefore spoke with some Navy officers in the Research and Analysis Division of the Navy Recruiting Command and were able to obtain their "best guesses" as to what travel costs might be. These are $500 per person for courses at San Diego and $300 for all other sites. Although crude, they are the best estimates of travel costs we could obtain. Each individual in the JOBS program incurs the entire transportation cost but the other variable costs are prorated according to the time the individual spends in JOBS training.

Table 5 gives the resulting average variable costs, in FY 1982 dollars, for each JOBS course.

When performing the cost-benefit analysis, we must determine, for each individual having attended JOBS training, the year, location, strand, and number of days spent in training. The corresponding cost per day per student from table 5 is then multiplied by the number of training days and added to transportation cost to determine the Navy's cost of training that individual.

"A" SCHOOL TRAINING COSTS

The "A" School training costs we need for our analysis are modifications of those provided through the TAEG accounting system. Angier et al. [9] give the training cost per graduate, in FY 1979 dollars, for most "A" school courses. These figures are then modified by computing the cost per enrollee using FY 1979 attrition rates.

TABLE 5

AVERAGE VARIABLE COSTS OF THE JOBS PROGRAM
(Excluding transportation)

Course	Cost per day per student
San Diego Operations FY 1980	32
San Diego Electronics FY 1980	32
San Diego Prop. Eng. FY 1980	32
San Diego Admin./Cler. FY 1980	32
San Diego Operations FY 1981	36
San Diego Electronics FY 1981	35
San Diego Prop. Eng. FY 1981	35
San Diego Admin./Cler. FY 1981	35
Memphis Electronics FY 1981	55
Great Lakes Prop. Eng. FY 1981	35
Meridian Admin./Cler. FY 1981	46

Unfortunately, only the total "A" school costs were received from TAEG. Therefore, we have no breakdown of accounting cost elements; in particular, we cannot sort out student travel costs. However, Warner et al. [8] found that, on average, 70 percent of total "A" school costs are variable. Thus, to estimate average variable training costs, we multiply the total cost per enrollee by 70 percent. To obtain costs per day of training, we need to compute the average number of work units (in days) per enrollee. This is defined (from [9]) as

$$\frac{WU}{E} = (1-ATTR) \times L \times (1 + 0.5 \times (ATTR/(1-ATTR)) + SR \times PR) , \quad (3)$$

where L is the course length in days, ATTR is the attrition rate, SR is the setback rate (the percentage of recruits set back), and PR is the setback proportion (the average proportion of the course repeated). The 0.5 appearing in equation (3) reflects the assumption that attriters leave midway through the course.

The average daily variable cost for each course is obtained by dividing the cost per enrollee by the number of work units per enrollee. Table 6 shows the daily costs, in FY 1982 dollars, for each "A" school course under consideration.

When computing the cost of training a particular individual, we must determine the number of days spent in each course, multiply them by the daily costs given in table 6, and add across courses.

TABLE 6

AVERAGE VARIABLE "A" SCHOOL COSTS PER DAY

		Course number			
Strand	Rating	1	2	3	4
Operations	QM	41			
	OS[a]	41			
Electronics	AX	44	33	35	41
	AT	44	32	35	41
	AQ	44	33	34	41
Prop. Eng.	MM	44	69[b]	29	
	EN	44	69[b]	22	
	BT	44	69[b]	54	
Admin./Cler.	YN	25	38		
	SK	25	40		
	PN	25	36		
	AK	25	37		

[a]Cost data are unavailable for this rating; we assume the cost is the same as for the QM rating.

[b]The second course in the PE sequence is PE Basic. This course is the same for MMs, ENs and BTs. However, CNET reported widely different costs for these three ratings. We therefore averaged the reported costs to obtain a common cost of $69.

COST-BENEFIT ANALYSIS

Using the cost figures given in the previous section, we now propose three measures of cost-effectiveness which enable us to compare the cost of the JOBS program with that of the traditional "A" school program. These are:

- Cost per "A" school graduate,
- Cost per man-month in the fleet following "A" school graduation,
- Cost per adjusted man-month in the fleet following "A" school graduation.

The adjustment used in the last measure above weights each month of service after "A" school graduation by a utility determined by length-of-service (LOS) and paygrade. The utilities indicate an individual's value to the Navy for each LOS/paygrade combination. They are used in the last measure of cost-effectiveness to take account of possibly different advancement patterns between JOBS and "A" school personnel. Utility matrices have been estimated for each Navy rating in [10].

From the population of JOBS and "A" school recruits, we selected only those that had complete training information. For example, a record indicating that a recruit had failed JOBS or "A" school training was considered complete. On the other hand, a record indicating that a recruit had graduated from JOBS school, but which gave no information on subsequent "A" school survival, was considered incomplete. There were, of course, other patterns of complete and incomplete information, but the general idea was to select those recruits for whom total training costs could be computed.

The composition of this subsample of complete records is shown in table 7.

TABLE 7

NUMBERS OF RECRUITS BY TRACK AND STRAND

	Strand			
Track	PE	OP	AC	EL
Direct JOBS	364	83	261	67
Delayed JOBS	156	118	173	21
Direct "A"	456	101	289	14
Delayed "A"	95	57	67	2

Each of the aforementioned cost-effectiveness measures is applied to this subsample. A detailed description of each measure follows.

COST PER "A" SCHOOL GRADUATE

This measures cost-effectiveness with the limited objective of getting recruits through "A" school. It has the advantage of being simple to compute and easy to interpret. It has the disadvantage, however, of ignoring any differences in subsequent fleet survival. To compute the cost per "A" school graduate, the cost elements described in the previous section are summed for each individual in the subsample (according to the individual's training pattern), are then summed across individuals, and finally are divided by the number of "A" school graduates. The numbers of "A" school graduates, by track and strand, are shown in table 8.

TABLE 8

NUMBERS AND PERCENTAGES OF "A" SCHOOL GRADUATES BY TRACK AND STRAND

	Strand			
Track	PE	OP	AC	EL
Direct JOBS	270 (74%)	62 (75%)	223 (85%)	29 (43%)
Delayed JOBS	106 (68%)	90 (76%)	145 (84%)	6 (29%)
Direct "A"	381 (83%)	99 (98%)	276 (96%)	6 (43%)
Delayed "A"	82 (86%)	57 (100%)	63 (94%)	0 (0%)

The resulting costs per "A" school graduate are shown in table 9. Two sets of costs are shown, one for each assumption about recruiting expenditures made in the previous section. As a reminder, these are:

Assumption 1: Recruiter and advertising expenses are incurred entirely by high school graduates in the upper mental groups. High school graduates in the lower mental groups and non-high school graduates incur only processing costs.

Assumption 2: Recruiter and advertising expenses are incurred equally by all high school graduates, regardless of mental group. Non-high school graduates incur only processing costs.

TABLE 9

COST PER "A" SCHOOL GRADUATE

Assumption 1

Track	Strand PE	OP	AC	EL
Direct JOBS	11,973	9,912	7,980	24,681
Delayed JOBS	13,339	9,544	8,853	35,566[a]
Direct "A"	10,563	10,863	10,374	32,048[a]
Delayed "A"	10,960	10,137	9,663	---

Assumption 2

Track	Strand PE	OP	AC	EL
Direct JOBS	18,872	15,493	13,049	30,377
Delayed JOBS	21,696	15,596	14,996	56,675[a]
Direct "A"	11,749	9,298	8,894	26,423[a]
Delayed "A"	12,391	9,161	9,535	--

[a] Since there are so few individuals in these categories, the resulting costs are imprecise.

Under assumption 1, the cost of getting a JOBS recruit through "A" school is less than that of an "A"-school-qualified recruit in all but the PE strand. Even in that strand, JOBS recruits are not much more expensive than "A"-school-qualified recruits, especially if the direct and delayed groups are compared separately (there is greater comparability within the direct and delayed groups than between them).

Under assumption 2, "A"-school-qualified recruits are much cheaper than JOBS recruits in all cases. But this is no surprise because the only opportunity the JOBS program has to make up for additional training expenses is in savings on recruiting individuals in the lower mental groups. By assuming that upper and lower mental group high school graduates cost the same to recruit, this opportunity is effectively denied. Thus, our conclusions boil down to whatever assumption about recruiting costs is more believable.

The consensus among manpower economists at CNA is that assumption 1 is much more reasonable than assumption 2, although the truth probably lies somewhere in between. Unfortunately, there are no studies we are

aware of that examine any other alternatives. Therefore, in the absence of any additional information, we conclude that, on the basis of cost per "A" school graduate, the JOBS program is cost-effective in the OP, AC, and EL strands, but marginally cost-ineffective in the PE strand.

COST PER MAN-MONTH IN THE FLEET

To obtain this measure, we use the same total costs computed previously but divide by the total number of man-months spent in the fleet by "A" school graduates. Time spent in the fleet before JOBS or "A" school training does not count. The problem that occurs in computing this measure is that most of the fleet times are censored, i.e., most individuals are still in the Navy as of March, 1983 and we do not know when they will attrite. Thus, we need to estimate the expected future survival time for any recruit not having already left the Navy. But to do this, we first have to estimate survival curves for each track and strand.

Each survival curve was estimated using the life table method (see [11]). They are graphed in figures 1-3 for all but the EL strand (there were no attritions in this group). If an individual is still in the fleet at time t, then his expected future survival time is obtained by taking the area under the appropriate survival curve beyond time t and dividing by the probability of surviving beyond time t. His total estimated fleet survival time is then the sum of his observed time t and his expected future survival time. In the case of the EL strand, where there were no fleet attritions, each individual is assumed to survive until the largest time in his track. Their survival times are generally smaller than those in the other strands since the majority took electronics courses given in FY 1981 and, consequently, have a shorter period of follow-up.

The costs per man-month in the fleet are shown in table 10. If assumption 1 is to be believed, we would draw the same conclusion from table 10 as before, i.e., the JOBS program is cost-effective for all but the PE strand.

As an example of the use of table 10, let us compare the cost of the JOBS program with the normal "A" school program in the PE strand, the objective being to get a trained individual through 36 months in the fleet. To obtain these costs, we merely multiply the costs given in table 10 by 36. Table 10 shows that a direct JOBS person costs $30 more per month than a direct "A" school person, and a delayed JOBS person costs $39 more per month than a delayed "A" school person. These translate into $1,080 and $1,404 differences, respectively, over a 36-month period. This says that, even if the Navy were to access a thousand JOBS recruits into the PE strand, which is a far more ambitious goal than at present, the total additional cost would only be between $1.0 and $1.5 million. Thus, in the event of a scarcity of "A"-school-qualified

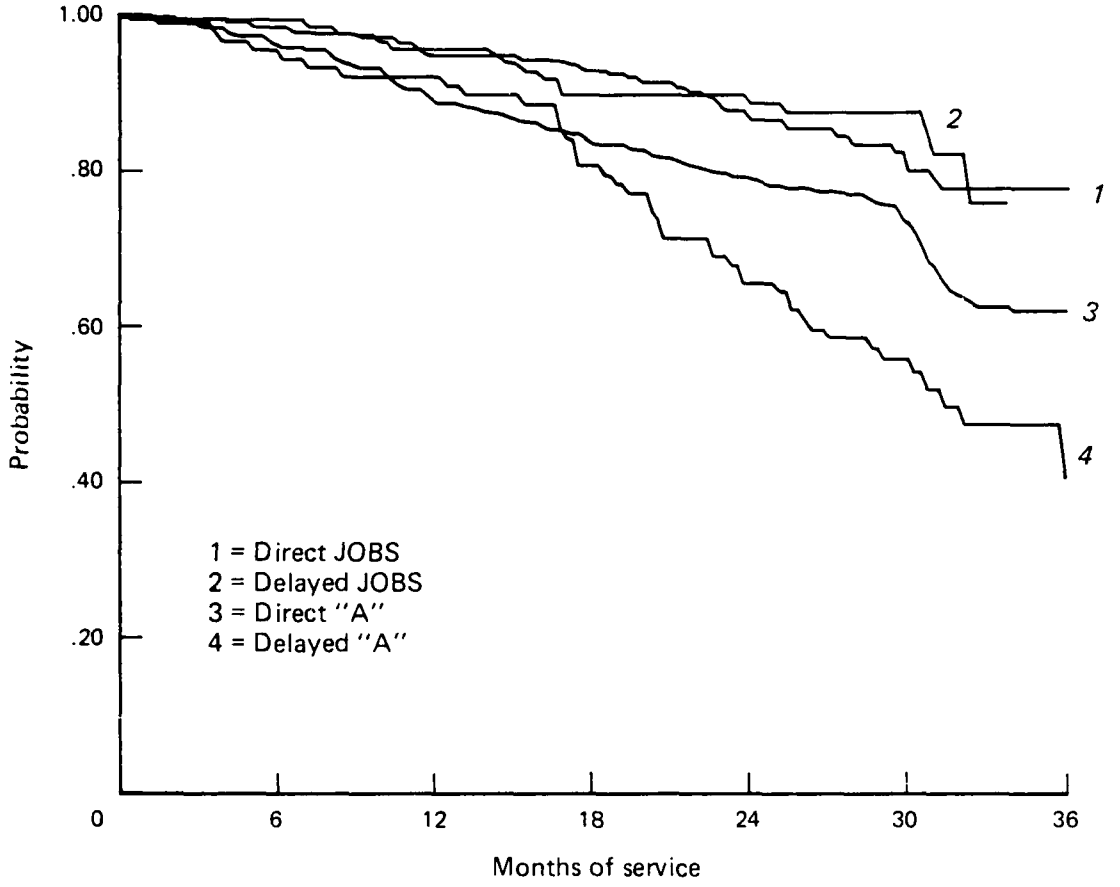

FIG. 1: FLEET SURVIVAL OF THE PE GROUP AFTER "A" SCHOOL GRADUATION

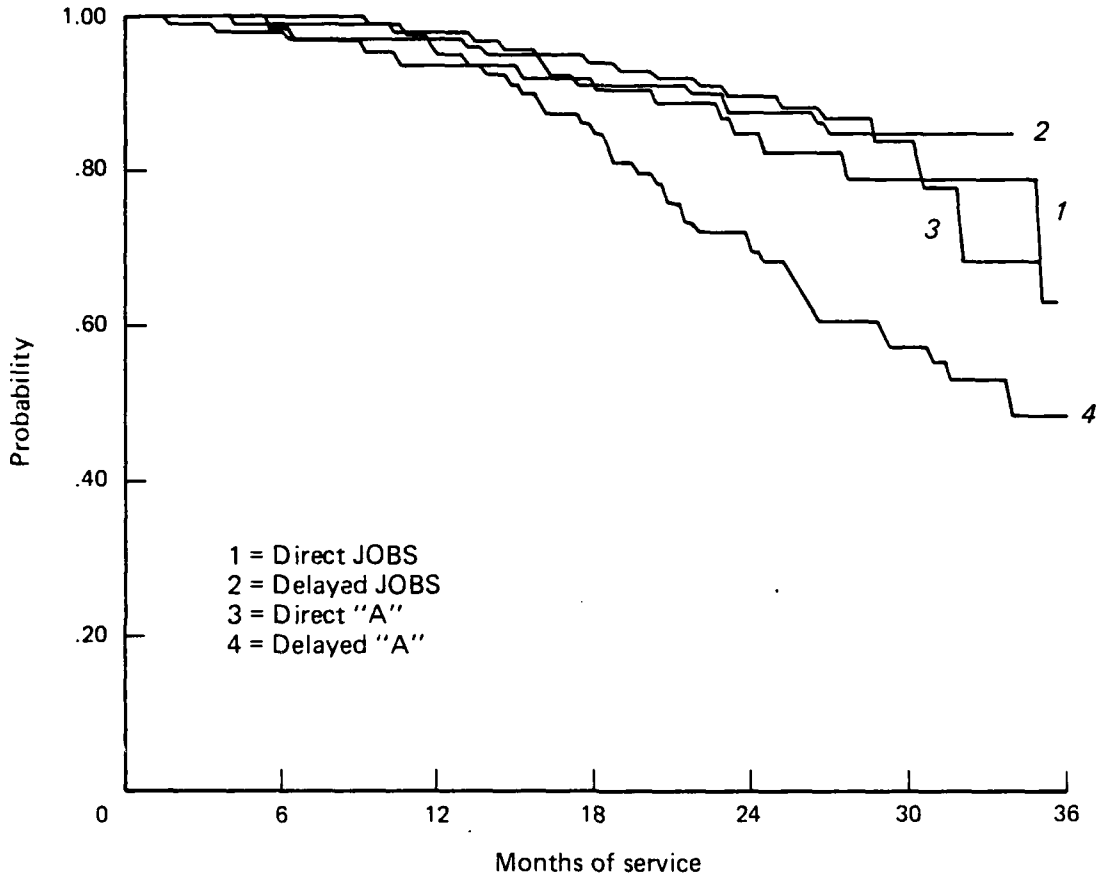

FIG. 2: FLEET SURVIVAL OF THE OP GROUP AFTER "A" SCHOOL GRADUATION

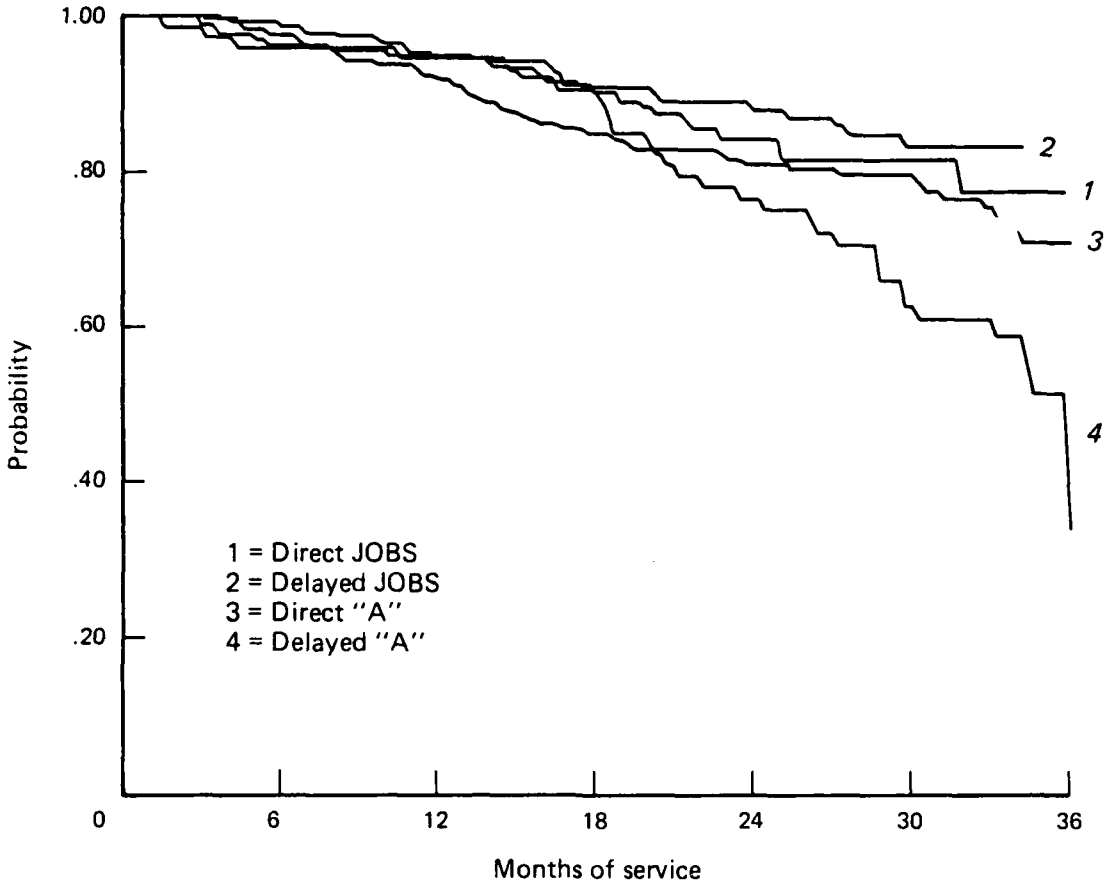

FIG. 3: FLEET SURVIVAL OF THE AC GROUP AFTER "A" SCHOOL GRADUATION

personnel, the JOBS program in the PE strand is only a slightly costlier alternative. For all other strands, it is a cheaper alternative.

TABLE 10

COST PER MAN-MONTH IN THE FLEET

Assumption 1

Track	Strand			
	PE	OP	AC	EL
Direct JOBS	342	312	247	1,187
Delayed JOBS	425	303	282	1,296[a]
Direct "A"	312	342	299	1,374[a]
Delayed "A"	386	338	321	--

Assumption 2

Track	Strand			
	PE	OP	AC	EL
Direct JOBS	537	485	407	1,465
Delayed JOBS	693	494	477	2,063[a]
Direct "A"	347	290	256	1,135[a]
Delayed "A"	433	308	316	--

[a] Since there are so few individuals in these categories, each having a relatively short period of follow-up, the resulting costs are very imprecise.

COST PER ADJUSTED MAN-MONTH IN THE FLEET

In computing the cost per man-month in the previous subsection, individuals with the same survival time were weighted equally, regardless of paygrade attained. Thus, for example, an E-4 with 3 years of service would be treated the same as an E-2 with a previous reduction in grade but with the same time in service. For this reason, it would be desirable to adjust for differences in advancement patterns among tracks and strands. To do this, we need some indication of the relative utilities to the Navy of the accrued experience of enlisted personnel as defined by LOS and paygrade. Such utilities, on a 0 to 100 scale, were estimated in [10] for each Navy rating. For the purpose of our study, only utilities for LOS 1 to LOS 4 and paygrades E-1 to E-5 are pertinent. The accrued utility matrices for the rating groups in our study

are shown in tables 11 and 12. Note that Yeomen have a higher accrued utility than other ratings in the AC group. This is because Yeomen are more involved (in a supporting role) with the decision-making process of the unit or organization.

TABLE 11

ACCRUED UTILITY MATRIX FOR THE PE AND EL GROUPS AND YEOMEN

	Paygrade				
LOS	E-1	E-2	E-3	E-4	E-5
1	5	10	10		
2	8	14	19	19	
3	11	19	22	29	29
4	11	20	26	38	38

TABLE 12

ACCRUED UTILITY MATRIX FOR THE AC GROUP (except Yeomen)

	Paygrade				
LOS	E-1	E-2	E-3	E-4	E-5
1	5	10	10		
2	10	12	12	12	
3	10	14	16	16	16
4	9	14	19	19	19

For individuals who graduated from "A" school, each subsequent month of fleet time was weighted by the utility corresponding to the appropriate LOS and paygrade. The resulting costs per adjusted man-month are shown in table 13. Since only the relative scale of the accrued utility matrix is important (i.e., only the ratios matter), we divided each utility value by 19 (corresponding to an E-3 in LOS 2 for all but the AC group) to bring the costs into the range of those determined by using unadjusted man-months of service.

The conclusions to be drawn from table 13 are generally the same as those drawn from the previous two measures of cost-effectiveness. A minor exception is that the delayed-track JOBS program is now very slightly more expensive than the delayed-track "A" school program in the OP and AC strands (if we believe more strongly in assumption 1). Due to the method used in calculating these costs, this reversal can only come about if delayed-track "A" school personnel advance more rapidly than

delayed-track JOBS personnel. We can, in fact, easily compute the average utilities (which measure advancement) accrued by personnel in each track and strand by dividing the costs in table 10 by those in table 13 and multiplying by 19. The results are shown in table 14.

TABLE 13

COST PER ADJUSTED MAN-MONTH IN THE FLEET

Assumption 1

	Strand			
Track	PE	OP	AC	EL
Direct JOBS	351	303	329	1,213
Delayed JOBS	373	260	321	897[a]
Direct "A"	321	351	403	1,447[a]
Delayed "A"	303	251	316	--

Assumption 2

	Strand			
Track	PE	OP	AC	EL
Direct JOBS	555	477	537	1,495
Delayed JOBS	607	425	546	1,426[a]
Direct "A"	355	303	347	1,192[a]
Delayed "A"	342	225	312	--

[a] Since there are so few individuals in these categories, each having a relatively short period of follow-up, the resulting costs are very imprecise.

TABLE 14

AVERAGE UTILITIES ACCRUED BY "A" SCHOOL GRADUATES

	Strand			
Track	PE	OP	AC	EL
Direct JOBS	18.5	19.6	14.3	18.6
Delayed JOBS	21.6	22.1	16.7	27.5
Direct "A"	18.5	18.5	14.1	18.0
Delayed "A"	24.2	25.6	19.3	--

The average utilities show that direct-track JOBS personnel advance at least as well as direct-track "A" school personnel. Delayed-track "A" school personnel, on the other hand, advance more rapidly than delayed-track JOBS personnel. It is important to make our comparisons only within the direct and delayed tracks because delayed track personnel will have had more opportunity to advance due to their additional time in service before initial skill training.

As an example of how to apply the cost-per-adjusted-man-month measure, let us suppose our objective is to obtain an individual with 36 months of service with the following advancement pattern: 6 months as an E-1, 6 months as an E-2, 18 months as an E-3, and 6 months as an E-4 (as of 36 months of service). We will compute the difference in cost between a direct-track JOBS and "A"-school-qualified person in the AC strand. From table 12, the number of adjusted man-months of service is $(6x5 + 6x10 + 12x12 + 6x16 + 6x16)/19 = 22.42$. The difference in cost shown in table 13 is \$74 per adjusted man-month, making the total difference \$74 x 22.42 = \$1,659 in favor of a direct-track JOBS person.

The disadvantage of the adjusted measure of cost-effectiveness is that it is more difficult to interpret than the other measures proposed. The objective must be specified in terms of a particular advancement pattern over time in order to determine the total savings involved by employing one program instead of the other. The suitability of the results also depends on how much stock one places in the utilities derived in [10]. If the utilities seem reasonable (and they do seem reasonable to us at least in the LOS/paygrade ranges we are dealing with), then despite interpretation difficulties, we would recommend using the cost-per-adjusted-man-month measure and, consequently, the conclusions derived from it.

COMPARISON OF JOBS WITH GENDET ATTRITION

In this section, we compare survival of JOBS-selected personnel with that of the fleet control group (those who were offered but refused JOBS training) to evaluate the incentive effects of the JOBS program. Although the JOBS program was never meant to be used as an incentive for retention, this may turn out to be a side benefit since past experience has shown that technically trained personnel remain in the Navy longer than do GENDETs. Rather than compare JOBS recruits with the entire GENDET population, however, we compare them only with the fleet control group since this represents a more homogeneous population in terms of education and mental group.

Using the life table method, survival curves for the fleet control group and the direct and delayed-track JOBS group were estimated. These are shown in figure 4.

As can clearly be seen, the survival curves for the three groups almost coincide with each other. That is, during their first term, there is little difference in survival among the three groups. Thus, the prospect of JOBS training, and in most instances, attendance at JOBS school, has no impact on length of service in the Navy.

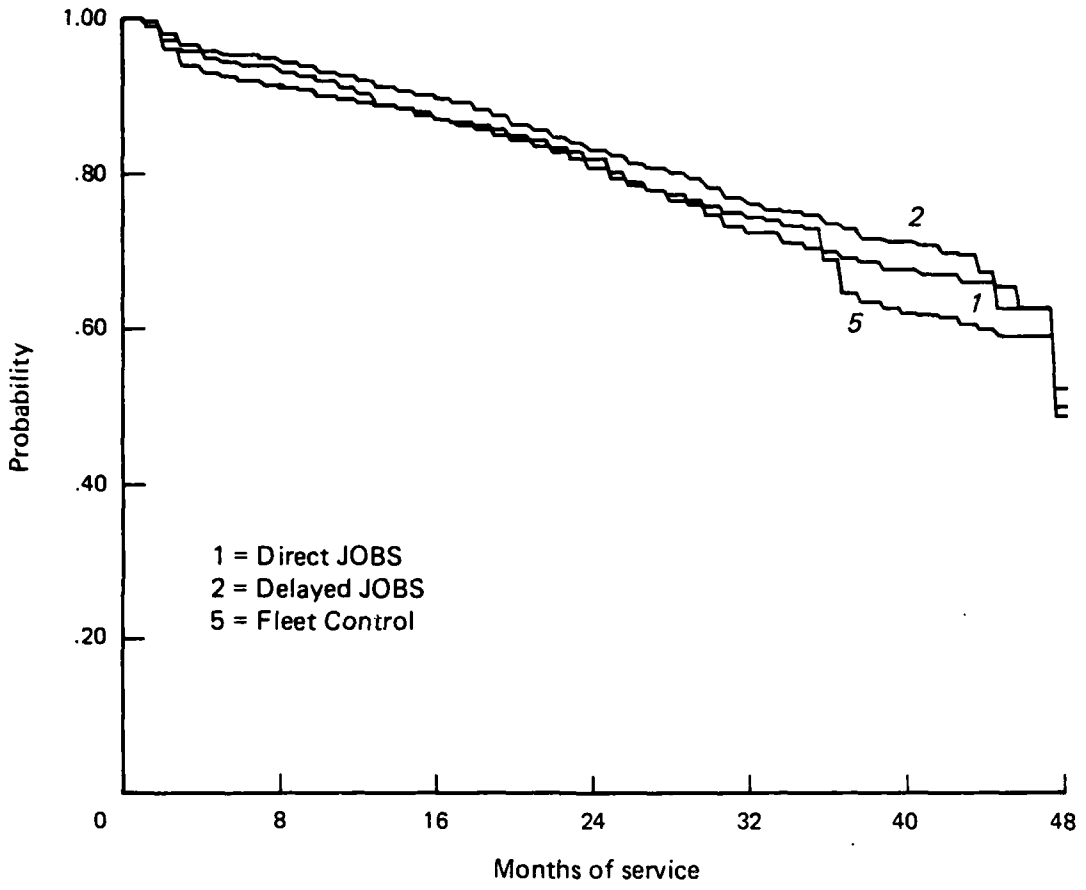

FIG. 4: TOTAL SURVIVAL OF THE JOBS AND FLEET CONTROL GROUPS

RECOMMENDATIONS

The results of this study show that the marginal costs of the JOBS program are almost the same as those of the regular "A" school program. In some strands, the JOBS program is marginally more expensive, and in others it is marginally cheaper, but in no case do the differences amount to any significant expenditures.

Even in cases where the JOBS program is cheaper, it would be foolish, of course, to suggest replacing "A"-school-qualified recruits with JOBS-qualified recruits. But we should keep in mind the main purpose of the JOBS program, i.e., to fill the shortages of technically trained personnel in the fleet created by the scarcity of "A"-school-qualified recruits. In the event the Navy should some day run again into problems recruiting enough high-quality individuals, the JOBS program could serve as a contingency which would achieve similar results at a similar cost. For this reason, we recommend the continuance of the JOBS program.

REFERENCES

[1] Navy Personnel Research and Development Center, Report TR 83-5, "Job-Oriented Basic Skills (JOBS) Training Program: An Evaluation," by Meryl S. Baker and Marc Hamovitch, Unclassified, Jan 1983

[2] Center for Naval Analyses, Research Contribution 409, "Recruiters, Advertising, and Navy Enlistments," by Larry Goldberg, Unclassified, Oct 1979

[3] Center for Naval Analyses, Memorandum 82-0079, "A Minimum Recruiting Cost Function for Male High School Graduates," by Deborah Clay-Mendez, Unclassified, 19 Jan 1982

[4] Center for Naval Analyses, Memorandum 82-0132, "Documentation for the Recruiting Cost Estimates Utilized in the Navy Comprehensive Compensation and Supply Study," by Deborah Clay-Mendez, Unclassified, 30 Sep 1982

[5] Center for Naval Analyses, Research Contribution 450, "Continuous Estimates of Survival Through Eight Years of Service Using FY 1979 Cross-Sectional Data," by Philip M. Lurie, Unclassified, Jul 1981

[6] General Accounting Office, Report FPCD-82-53, "Success of the Programmed School Input Program Justifies Expansion," Unclassified

[7] Center for Naval Analyses, Study 1176, "Balancing Accession and Retention (Final Report of the Navy Comprehensive Compensation and Supply Study)," by Deborah Clay-Mendez et al., Unclassified, Sep 1982

[8] Center for Naval Analyses, Research Contribution 337, "Modelling the Costs of Specialized Training, by John T. Warner et al., Unclassified, Aug 1977

[9] Center for Naval Analyses, Memorandum 82-0497, "Construction of Training Cost per Graduate for the Navy Comprehensive Compensation and Supply Study," by Bruce N. Angier et al., Unclassified, 4 Nov 1982

[10] Decisions and Designs, Inc., Technical Progress Report, "Accrued Utility of Navy Enlisted Personnel," by Vincent N. Campbell et al., Unclassified, Sep 1976

[11] Center for Naval Analyses, Research Contribution 402, "Nonparametric Methods for Estimating Recruit Survival with Cross-Sectional Data," by Philip M. Lurie, Unclassified, Sep 1979

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